

WHAT IS CLAIMED IS:

1. A method of manufacturing a liquid crystal display, comprising the steps of:

5 providing a first alignment layer on a first substrate;

rubbing said first alignment layer such that said first alignment layer has a first pretilt angle associated therewith;

10 providing a second alignment layer on a second substrate;

exposing said second alignment layer to light such that said second alignment layer has at least one second pretilt angle associated therewith; and

15 providing a liquid crystal material between said first and second substrates.

2. A method in accordance with claim 1, wherein said first alignment layer comprises polyimide.

20 3. A method in accordance with claim 1, wherein said second alignment layer comprises polysiloxane based materials.

25 4. A method in accordance with claim 1, wherein

said light includes linearly polarized light.

5           5. A method in accordance with claim 1, wherein  
said exposing step further comprises the steps of:

generating unpolarized light; and

transmitting said unpolarized light through a  
polarizer to generate said linearly polarized light.

10           6. A method in accordance with claim 5, wherein  
said linearly polarized light includes linearly polarized  
ultraviolet light.

15           7. A method in accordance with claim 1, wherein  
said light is incident substantially perpendicular to  
said second alignment layer.

            8. A method in accordance with claim 1, wherein  
said light comprises ultraviolet light.

20           9. A method in accordance with claim 1, wherein  
said exposing step includes a single exposure to said  
light.

25           10. A method in accordance with claim 1, wherein  
a plurality of pretilt angles are associated with said

second alignment layer after said exposing step, said plurality of pretilt angles being oriented in respective pretilt directions, said providing step further comprising the step of injecting said liquid crystal material between said first and second substrates so as to select ones of said plurality of pretilt angles oriented in a single direction.

11. A method in accordance with claim 7, wherein said photo-incidation is further comprising the step of exposing additional light to select ones of said plurality of pretilt angles oriented in a single direction.

12. A method in accordance with claim 11, wherein said additional light comprises unpolarized light.

13. A method in accordance with claim 12, wherein said unpolarized additional light is obliquely incident to the second alignment layer.

14. A method in accordance with claim 1, wherein said exposing step is comprising the steps of; exposing said second alignment layer to a polarized light in the perpendicular direction; and

exposing said second alignment layer to a nonpolarized light in the oblique direction.

15. A method in accordance with claim 1,  
5 wherein said exposing step is comprising the steps of;  
exposing said second alignment layer to a nonpolarized light in the oblique direction; and  
exposing said second alignment layer to a polarized light in the perpendicular direction.

10 16. A method in accordance with claim 1, wherein said exposing steps further comprises the steps of:

15 exposing said second alignment layer to a first light such that a plurality of pretilt angles are associated with said second alignment layer, said plurality of pretilt angles being oriented in respective pretilt directions,

20 exposing a first portion of said second alignment layer to a second light so as to select ones of said pretilt angles associated with said first portion oriented in a first direction; and

25 exposing a second portion of said second alignment layer to a third light so as to select ones of said pretilt angles associated with said second portion oriented in a second direction.

17. A method in accordance with claim 16, wherein  
said first light includes linearly polarized light.

18. A method in accordance with claim 16, wherein  
said first light is incident substantially perpendicular  
to a surface of said second alignment layer.

19. A method in accordance with claim 16, wherein  
said second light and/or said third light  
include/includes unpolarized light.

20. A method in accordance with claim 19, wherein  
said second light and/or said third light  
are/is incident obliquely to said surface of said second  
alignment layer.

21. A method in accordance with claim 1, further  
comprising the steps of:

providing a third alignment layer on a portion of  
said first alignment layer;

rubbing said third alignment layer such that said  
third alignment layer has a third pretilt angle  
associated therewith.

22. A method in accordance with claim 21, wherein

said third alignment layer has a pretilt angle forming characteristics differing than the first alignment layer's.

5           23. A method in accordance with claim 21, wherein said third pretilt angle has a magnitude greater than said first pretilt angle.

10           24. A method in accordance with claim 1, further comprising the steps of:

15           exposing a first portion of said second alignment layer to a first dose of a first light such that a first plurality of pretilt angles having respective pretilt directions are associated with said first portion of said second alignment layer, and

20           exposing a second portion of said second alignment layer to a second dose of said first light such that a second plurality of pretilt angles having respective pretilt directions are associated with said second portion of said second alignment layer.

25           25. A method in accordance with claim 24, further comprising the steps of:

          exposing said first portion of said second alignment layer to a first dose of a second light to select ones of

said pretilt angles associated with said first portion of said second alignment layer; and

exposing said second portion of said second alignment layer to a second dose of said second light to select ones of said pretilt angles associated with said second portion of said second alignment layer.

26. A method in accordance with claim 24, wherein said first light includes linearly polarized light.

27. A method in accordance with claim 28, wherein said first light is incident substantially perpendicular to said surface of said second alignment layer.

28. A method in accordance with claim 24, wherein said first plurality of pretilt angles each have a magnitude greater than a magnitude of each of said second plurality of pretilt angles.

29. A method in accordance with claim 25, wherein said second light includes unpolarized light.

30. A method in accordance with claim 25, wherein said second light is incident obliquely to said surface of said second alignment layer.

31. A method in accordance with claim 24, wherein said first light is supplied to said second alignment layer through a plate having a first part aligned with said first portion of said substrate and having a first transmissivity, and a second part aligned with said second portion of said second alignment layer and having a second transmissivity.

32. A method in accordance with claim 25, wherein said second light is supplied to said second alignment layer through a plate having a first part aligned with said first portion of said second alignment and having a first transmissivity, and a second part aligned with said second portion of said second alignment layer and having a second transmissivity.

33. A method in accordance with claim 1, wherein said exposure step further comprises the steps of:

exposing a first portion of said second alignment layer to a first light such that a first pretilt angle oriented in a first direction is associated with said first portion of said second alignment layer;

exposing a second portion of said second alignment layer to a second light such that a second pretilt angle oriented in a second direction is



associated with said second portion of said second alignment layer,

5 exposing a third portion of said second alignment layer to a third light such that a third pretilt angle oriented in a third direction is associated with said third portion of said second alignment layer; and

10 exposing a fourth portion of said second alignment layer to a fourth light such that a fourth pretilt angle oriented in a fourth direction is associated with said fourth portion of said second alignment layer.

15 34. A method in accordance with claim 33, wherein at least ones of said lights includes unpolarized light, the lights including the first light, the second light, the third light, and fourth light.

20 35. A method in accordance with claim 34, wherein at least ones of said lights is incident obliquely to said surface of said second alignment layer the lights including the first light, the second light, the third light, and fourth light.

25 36. A method in accordance with claim 1, wherein the exposing step is comprising the steps of:

exposing a first portion of said second alignment layer to a first polarized light in the first perpendicular direction; and

5 exposing a second portion of said second alignment layer to a second polarized light in the second perpendicular direction

37. A method in accordance with claim 36, wherein the exposing step is further comprising the steps of:

10 exposing a first portion of said second alignment layer to a first unpolarized light in the first oblique direction; and

15 exposing a second portion of said second alignment layer to a second unpolarized light in the second oblique direction.

38. A method in accordance with claim 36, wherein the exposing step is further comprising the steps of:

20 exposing a first area of a first portion of said second alignment layer to a first unpolarized light in a first oblique direction;

exposing a second area of a first portion of said second alignment layer to a second unpolarized light in a second oblique directionand:

25 exposing a first area of a second portion of said

second alignment layer to a third unpolarized light in a third oblique direction: and

5 exposing a second area of a second portion of said second alignment layer to a fourth unpolarized light in a fourth oblique direction.

39. A method of manufacturing a liquid crystal display, comprising the steps of:

10 coating a first substrate with a first alignment layer;

rubbing said first alignment layer to impart a first alignment direction, a first pretilt angle direction and a first pretilt angle magnitude;

15 coating a second substrate with a second alignment layer;

exposing said second alignment layer to impart a second alignment direction, a plurality of second pretilt angles each having a second pretilt angle magnitude and oriented in a plurality of pretilt angle direction; and

20 injecting liquid crystal material between said first and second substrates to select those of said plurality of pretilt angles oriented in one of said pretilt angle directions.

25 40. A method of manufacturing a liquid crystal

cell in accordance with claim 39, wherein said first alignment layer includes polyimide.

5 41. A method of manufacturing a liquid crystal cell in accordance with claim 39, wherein said second alignment layer includes a polysiloxane based material.

10 42. A method of manufacturing a liquid crystal cell in accordance with claim 39, wherein during said exposing step, said light is incident substantially perpendicular to said second alignment layer.

15 43. A method of manufacturing a liquid crystal cell in accordance with claim 39, wherein said light comprises ultraviolet light.

20 44. A method of manufacturing a liquid crystal cell in accordance with claim 43, wherein said ultraviolet light comprises linearly polarized ultraviolet light.

25 45. A method of manufacturing a liquid crystal cell in accordance with claim 39, wherein said exposing step includes a single exposure of said second alignment layer to said light.

46. A method of manufacturing a liquid crystal cell in accordance with claim 39, wherein said first pretilt angle direction is different from said second pretilt angle direction.

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47. A liquid crystal display device comprising:  
a first substrate;  
a rubbed layer provided on said first substrate;  
a second substrate;  
a photo-aligned layer provided on said second substrate; and  
liquid crystal material provided between said first and second substrates.

48. A liquid crystal display device in accordance with claim 47, wherein said rubbed layer comprises polyimide.

49. A liquid crystal display device in accordance with claim 47, wherein said photo-aligned layer comprises a polysiloxane based material.

50. A liquid crystal display device in accordance with claim 47, wherein first molecules of said liquid crystal material adjacent said rubbed layer are aligned

in a first direction, the first direction having a first pretilt angle and a first pretilt angle direction associated with said rubbed layer.

5           51. A liquid crystal display device in accordance with claim 47, wherein second molecules of said liquid crystal material adjacent said photo-aligned layer are aligned in a second direction, the second direction having a second pretilt angle and a second pretilt angle direction associated with said photo-aligned layer.

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55. A liquid crystal display device in accordance with claim 47, wherein said first pretilt angle direction is different with said second pretilt angle direction.

5 56. A liquid crystal display device in accordance with claim 55, wherein said first pretilt angle direction is substantially perpendicular to said second pretilt angle direction.

10 57. A liquid crystal display device in accordance with claim 55, wherein said first pretilt angle direction is substantially anti-parallel to said second pretilt angle direction.

15 58. A liquid crystal display device in accordance with claim 47, wherein pluralities of liquid crystal molecules are provided adjacent respective portions of said photo-aligned layer, each plurality of liquid crystal molecules having a corresponding pretilt angle and pretilt direction.

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